

## REMARKS

Claims 1-29 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter that the applicant regards as the invention.

Reconsideration is requested in view of this Amendment.

Claim 1 has been amended in order to avoid the objections raised by the Examiner under both 35 U.S.C. §112, second paragraph, for failing to particularly point out and distinctly claim the subject matter that the applicant regards as the invention.

Reconsideration is requested.

The main metal body has been specified as "open at a first base end, and having a housing for a gas distributor at a second base end and wherein said housing has a volume inside thereof and an internal lining of a coating of refractory material having a housing for a gas distributor at a second base end and internally lined with a coating of refractory material". Support for this recitation is found at page 6, lines 5-7 and 20-22, of the specification.

The inner lance has been redefined as an "inner central lance ... arranged inside said main metal body". Support for this amendment is found at page 6, lines 8-11, of the specification as originally filed, in figures 6, 9 and 10, where it is clearly disclosed.

The two outer lances have been specified as "outer side lances for combustible gas associated with said main metal body". Support for this amendment is found on page 6, lines 9-11, and page 16, lines 6-9, of the specification and in figures 6 and 7 of the drawings.

The term "adduction", which refers to the single duct through which the pre-heated air is introduced into the main metal body, has been replaced by the term "introduction" for greater clarity.

The single duct for introducing the pre-heated air inside the main metal body has been specified to be "connected to the side surface of said main metal body". Support for this amendment given on page 6, lines 15-17, of the description of the present application as originally filed and in figures 6, 7, 9-10, 12 and 13 as originally filed;

The refractory unit has been specified to be "associated with said first base end". This feature is clearly and disclosed in the drawings, i.e., figures 1, 6, 9 and 10).

The nozzles for the injection of the pre-heated air into the combustion chamber have been specified to be "situated in said refractory unit", "in communication with one and the same plenum defined by the volume inside said coating" and "located between the inner central lance and the outer side lances". The first feature is supported by the text of the specification at page 8, lines 15-17 and in figures 1, 2 and 5. With regard to the second feature, please note that it is clearly and unambiguously disclosed at page 6, lines 23-25 to page 7, lines 1-3, and page 11, lines 17-21, of the description and in figures 9 and 10 of the drawings. As to the third feature, this feature is supported by the disclosure in figures 1, 2 and 8 of the drawings.

The combustion chamber has been specified to be that of "an oven" and support for this term is found on page 8, lines 15-18, and in the figures of the present application as originally filed.

The gas regulation system has been specified as comprising "means for varying the distribution percentage of the combustible gas between the inner central lance and the outer side lances". Support for this amendment is found at page 11, lines 6-16, of the specification.

The flame functioning mode has been specified to be that in which "the combustible gas is injected to

said combustion chamber through said inner central lance alone''. Support for this amendment is found at page 12, lines 19-21, and page 14, lines 1-3, of the specification.

The flameless functioning mode has been specified to be that in which ''the combustible gas is injected to said combustion chamber through said outer side lances alone''. Support for this amendment is found at page 12, lines 19-25; and page 13, lines 1-5 and page 14, lines 1-3 of the specification.

The term "low" has been moved from the main body of the claim to the preamble in order to more properly define the invention. This avoids any questions that the structure as defined by the claim is indefinite.

Claim 2 has been amended to structurally define the ''free annular crown'' and its relationship with the other components of the burner, it has been specified that the first region of the refractory unit further comprises ''a central hole from which the gas flows out and which houses a tip portion of said inner central lance, a free annular crown being defined between the inner surface of said central hole and the external diameter of said tip portion of the inner central lance, said free annular crown being in communication with said plenum''. Support for this amendment is found at page 9, lines 2-10, page 9, lines 16-25, and page 10, lines 1-4, of the specification and in figures 9, 10 and 11 of the drawings which disclose that central hole houses a tip portion of the inner central lance and that the said annular portion is in communication with the volume (plenum) inside the lined main metal body.

Amended claim 2 points out that ''air'' is actually ''pre-heated air'' that is the air introduced through the single duct as disclosed in the specification at page 12, line 23 to page 13, line 11. The term ''calibrated'' referred to the holes and this term is readily understood b those who are skilled in the art to

describe the selection of the dimensional ratios specified in the present specification with regard to the operating parameters of an actual burner in order to achieve the results disclosed for the present invention at pages 3-4 of the specification.

Dependent claims 3 to 26 have been made consistent with new claims 1 and 2. In all the new claims the reference numbers in parentheses have been canceled. The objections to claims 2, 9, 23 and 25 have been avoided by amending these claims to provide a proper antecedent basis for each term in the claims. For these reasons, it is respectfully submitted that the proposed amendments avoid the rejections of record and withdrawal of the rejections under Section 112 is requested.

Claims 1-3, 5, 7, 8 and 10 were rejected under 35 U.S.C. §102(b) as anticipated by Hovis or Hovis in view of Cornelius or Wunning. Claims 4, 10-21 and 26-29 were rejected under 35 U.S.C. §103(a) as being unpatentable over Hovis alone or Hovis in view of Cornelius or Wunning, as applied to claims 1-3, 5, 7, 8 and 10, and further in view of AT 358702 the Manich patent).

Reconsideration is requested.

Hovis discloses a burner in figures 8-10 which the specification describes as a burner capable of being efficiently operated during both the starting heating period and the final end period of the soaking period in a soaking-pit furnace (col. 2, lines 7-28, of Hovis. In both of these operating modes, the burner operates in a flame condition. This is clearly evident from the fact that the burner has two firing ports, namely an inner firing chamber or port 84' and an outer firing chamber or port 76', in both of which a flame front is established during any of the possible operating conditions (col. 9, lines 47-66, col. 2, lines 34-35 and 44-45, of Hovis. In particular, it is noted that the outer firing chamber or port 76', which "confines" the flame and does not allow a flame-less functioning mode. The same applies to

the inner firing chamber or port 84'.

The inner part of the body 68' of the burner has defined two separate and distinct volumes (plenum) selectively fed with air, namely:

- in the burner of figures 8-9: the annular air conduit 94' fed through the valve 122 and the annular chamber defined around it inside the burner, selectively fed through respective valves (figure 8);
- in the burner of figures 10-11: the body chambers 138 and 140, selectively fed through the valve 134.

The body 68' of the burner further comprises:

- Outer air passages 78', which communicate with a respective "plenum" (namely, in figure 8, the volume defined around the conduit 92 and, in figure 10, the volume defined by the chamber 140);
- Inner air passages 88', which communicate with a respective "plenum" (namely, in figure 8, the volume defined inside the conduit 92 and, in figure 10, the volume defined by the chamber 138) different and separate from the "plenum" communicating with the outer air passages 78'. The body 68' of the burner further comprises:
  - Inner air passages 88', which communicate with a respective "plenum" (namely, in figure 8, the volume defined inside the conduit 92 and, in figure 10, the volume defined by the chamber 138) different and separate from the "plenum" communicating with the outer air passages 78'. The body 68' of the burner further comprises:

- a first fuel inlet 92' arranged axially in the body 68' and having a fuel opening 90' communicating with the inner firing port 84'; the inner air passages 88' being located around the fuel opening 90' (see figures 8-11 of US' 062);

- a second fuel inlet 112' which is arranged on a side of the body 68 and which feeds the fuel to gas flow grooves 116' that are defined around and externally the inner air passages 88'; the outer air passages 78' being arranged

around and externally the gas flow grooves 116' (see figures).

The two main operating modes of the Hovis burner (both "flame" modes) are based on "suitably manipulating fuel and air valves", that is to say that, according to Hovis, the two main operating modes are achieved not only by suitably manipulating the fuel valves, but also by suitably manipulating (selectively closing and opening) the air valves which control the air feeding flow to the two separate plenum as disclosed at col. 9, lines 20-65, and col. 10, lines 1-57 of Hovis.

In light of the above it is clear that Hovis does not disclose at least the following features of amended claim 1:

- "a series of nozzles situated in said refractory unit for the injection of the pre-heated air into a combustion chamber of an oven, said series of nozzles being in communication with a plenum defined by the volume inside said housing that is internally lined with a coating of refractory material and is located between the inner central lance and the outer side lances, and in that, said gas regulation system comprises means for varying the distribution percentage of the combustible gas between the inner central lance and the outer side lances thereby switching from a flame functioning mode of the burner, wherein the combustible gas is injected to said combustion chamber through said inner central lance alone, to a flameless functioning mode, wherein the combustible gas is injected to said combustion chamber through said outer side lances alone".

It is further noted that Hovis does not disclose a "free annular crown" for the passage of the pre-heated air around the tip portion of the central fuel inlet 92, as defined in amended claim 2. The annular baffle 86', cited by the Examiner, does not define a free annular crown around the external diameter of the central fuel inlet 92.

Cornelius refers to a combustion apparatus for a gas turbine operating with a liquid hydrocarbon fuel provided with a swirl device for the air flow (abstract, col. 2, lines 44-46, col. 3, lines 28-30, of Cornelius). The combustion apparatus comprises a reaction chamber 35 in which combustion takes place. The reaction chamber 35 communicates at one end with an upstream pre-chamber 32 and at the opposite end with a transition conduit 10 to a turbine (col. 3, lines 8-and, 53-55, of Cornelius).

A fuel pipe 18 feeds the liquid fuel to a spray nozzle 16 located upstream to the pre-chamber 32 (col. 3, lines 25-31, of Cornelius). The primary combustion air is fed through the primary air entrance 22 arranged upstream of the pre-chamber 32 (col. 3, lines 33-45, col. 4, lines 19-21, of Cornelius).

The primary air entrance 22 is provided with a plurality of apertures 24 the opening of which is adjusted by means of a rotatable sleeve 66 arranged around the structure 22 (col. 4, lines 54-66, of Cornelius).

A dilution zone is provided at the downstream portion of the combustion apparatus. The dilution zone comprises a plurality of ports 46 allowing the introduction inside the reaction chamber of secondary or dilution air. The opening of the ports 46 is adjustable by means of a sleeve 50 arranged around the wall 45. In the swirl-mode, the primary combustion air flow swirls so as to recirculate the combustion products from the reaction chamber into the pre-chamber 32 (col. 5, lines 53-58, col. 6, lines 39-53, of US'413) in order to better mixing the air with the atomized fuel (col. 1, lines 53-57, of Cornelius). In the normal operating swirl of the primary air is reduced or eliminated so that no recirculation of the combustion product back to the pre-chamber 32 occurs (col. 1, lines 57-66, col. 5, lines 59-62, col. 6, lines 54-58, of Cornelius).

It is noted that in Cornelius, the switch from one operating mode to the other, as well the rate of dilution of the combustion products are achieved by means of primary and secondary air flows adjusting means (i.e. the sleeves 60 and 50 varying the opening of the apertures 24 and 46 respectively). Moreover, in Cornelius a single fuel nozzle 16 is provided. In light of the above, it is clear that Cornelius does not disclose at least the following features as specified in new claim 1:

- "A gas burner ... " wherein the pre-heated air and the gas are fed into a "combustion chamber of an oven"; on the contrary Cornelius relates to a combustion apparatus for a gas turbine operating with a liquid hydrocarbon fuel;
- "an inner central lance for combustible gas ... at least two outer side lances for combustible gas"; on the contrary in the combustion apparatus of Cornelius only one spraying nozzle 16 for the liquid fuel is present;
- "a refractory unit" arranged at one end of the main body and comprising "a series of nozzles situated in said refractory unit for the injection of the pre-heated air into the combustion chamber of an oven" wherein "said series of nozzles being in communication with one and the same plenum defined by the volume inside said coating and being located between the inner central lance and the outer side lances"; in the combustion apparatus of Cornelius no outer side lances for the injection of combustible gas are present at all;
- a gas regulation system that "comprises means for varying the distribution percentage of the combustible gas between the inner central lance and the outer side lances"; in the combustion apparatus of US' '413 no outer side lances for the injection of combustible gas are disclosed.

Wunning refers to an impulse burner comprising:

- a jacket tube 1 joined at one end with a combustion chamber 9;



- the combustion chamber 9 ends with outlet openings 10;
  - a lateral air supply stub 15 connected to the jacket tube 1 and provided with an air valve 16;
  - two fuel central lances 17 and 18 coaxial with one another, the outer lance 17 having radial nozzles 15 communicating with the combustion chamber 9 and the inner lance 18 having an axial nozzle 26 which opens directly inside the furnace chamber 4;
  - two fuel supply stubs 20, 21 connected to the two fuel lances 17, 18, wherein each of the fuel supply stubs 20 and 21 includes a fuel valve 22 and 23;
- (col. 5, lines 26-30 and 48-64, col. 6, lines 4-17, and figure 1 of Wunning).

To start the Wunning burner in the cold state, the combustion air valve 16 and the fuel valve 22 of the outer lance 17 are opened, while the fuel valve 23 of the inner lance is closed. The fuel is introduced in the combustion chamber 9, where it mixes with the air and ignited by the igniting electrode 28. Flame gases emerge through the openings 10 of the combustion chamber 9.

As soon as the furnace chamber 4 has been heated up to the ignition temperature of the fuel, the fuel valve 22 is closed, so that no further fuel is fed through the outer lance 17, and the fuel valve 23 is opened, so that the fuel is fed through the inner lance 18 and the air flows into the furnace chamber 4 through the outlet openings 10 (col. 6, lines 66-67, col. 7, lines 1-47, of US'679).

It is noted that, in the Wunning burner, the outlet openings 10 alternatively or simultaneously inject inside the furnace chamber 4, the combustion products emerging from the combustion chamber 9 and the air. It is further noted, that in the flame operating mode of the burner of US'679 the fuel is fed through the outer lance 17, while in the "flame free" operating mode the fuel is fed through the inner lance 18, the inner lance 18 being axially arranged inside the outer lance 17.

In light of the above it is clear that Wunning does not disclose at least the following features as specified in amended claim 1:

- "an inner central lance for combustible gas arranged inside said main metal body" and "at least two outer side lances for combustible gas associated with said main metal body";
- "a refractory unit ... comprises a series of nozzles ... for the injection of the pre-heated air into the combustion chamber of an oven, said series of nozzles being in communication with a same plenum defined by the volume inside said housing that is internally lined with a coating of refractory material and is located between the inner central lance and the outer side lances";
- a gas regulation system that "comprises means for varying the distribution percentage of the combustible gas between the inner lance and the outer lances thereby continuously switching from a flame functioning mode of the burner, wherein the combustible gas is injected to said combustion chamber through said inner central lance alone, to a flameless functioning mode, wherein the combustible gas is injected to said combustion chamber through said outer side lances alone".

With regard to AT358702 (the Manich patent), is respectfully submitted that, contrary to the Examiner's opinion, the elements labeled with the reference numeral "13" are not fuel lances, on the contrary they are "swirling" elements inserted inside through holes 12 for the passage of air (reference is made to claim 6 of AT'702). It is further noted that the said through holes 12 for the passage of air are located outside the conduits 15 and 16 feeding gas and oil fuel.

For these reasons, it is respectfully submitted that the amended claims define novel and unobvious subject matter over Hovis alone or over Hovis in view of Cornelius or Wunning, since none of the cited prior art patents disclose or further suggests a gas burner as

defined in the amended claims.

The dependent claims add further limitations to independent claim 1 from which they each either directly or indirectly depend and these claims are patentable for the same reasons given in support of the patentability of amended claim 1.

An early and favorable action is earnestly solicited.

Respectfully Submitted



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